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ADP013953

TITLE: The Mechanisms of Gravito-Photophoresis for Aerosol Aggregates  
in the Free-Molecular Regime

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TITLE: 2002 International Conference on Mathematical Methods in  
Electromagnetic Theory [MMET 02]. Volume 2

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## THE MECHANISMS OF GRAVITO-PHOTO-PHORESIS FOR AEROSOL AGGREGATES IN THE FREE-MOLECULAR REGIME

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The gravito-photophoretic forces in the free-molecular regime are calculated for the some types of aerosol particles by using the Monte-Carlo method to estimate molecular transfer. The absorption cross sections of aggregate components are calculated according to the results of the light scattering theory for fractal systems obtained within the framework of Berry-Percival's method and in the work by S.D. Andreev.

It is shown that two types of gravito-photophoresis can contribute to the levitation of aerosol particles absorbing the Sun and the Earth's radiation. There is a well-known  $\Delta\alpha$ -gravito-photophoresis [1] caused by a difference in the thermal accommodation coefficient, and there is a  $\Delta T$ -gravito-photophoresis, when the aerosol aggregate consists of individual particles differing in temperature due to a difference in the physical properties and the radiation absorption power.

Both mechanisms can induce large-value lifting forces able to provide a vertical transport of aerosol particles into the upper atmosphere. A connection between the existence of aerosol layers at the altitudes near 20, 50, 70-100 km in the real Earth's atmosphere, according to the results of our space observations in the ultraviolet range [2], and a condition of the balance of photophoretic and gravity forces is shown.

### REFERENCE

- [1] R.F. Pueshel, S. Verma, H. Rohatschek, G.V. Ferry, N. Boiadjeva, S.D. Howard, A.W. Strawa. Vertical transport of anthropogenic soot aerosol into the middle atmosphere. *J. Geophys. Res.*, 2000, vol. 105, No. D3, pp. 3727-3736.
- [2] A. Cheremisin, L. Granitskii, V. Myasnikov, N. Vetchinkin. Improved aerosol scattering in the upper atmosphere according to data of ultraviolet observations from space, with instrumental smoothing taken into account, *SPIE*, 2000, vol. 4341, pp. 383-389.